REMARKS/ARGUMENTS

Claims 13-16, 19-22, and 24-33 are pending. Claims 17, 18, and 23 have been canceled without prejudice and without disclaimer. Claims 13-16, 19-22, and 24-26 have been amended. New claims 27-33 have been added. No new matter has been introduced. Applicants believe the claims comply with 35 U.S.C. § 112.

Applicants would like to thank Examiner Jared Ian Rutz and Supervisory Patent Examiner Donald Sparks for the courteous interview extended to Applicants' counsel, Chun-Pok Leung, and Applicants' representative, Hiroshi Kawano, on October 20, 2005. During the interview, proposed amendments to claim 13 and to other claims to overcome the rejection over prior art and section 112 rejections were discussed. More specifically, Applicants' counsel and representative presented arguments that the cited references do not teach writing data related to the write command to the first logical volume and not writing the data to the second logical volume based on receiving the write command during a period of changing from a first status to a second status.

Claims 13-26 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Cabrera et al. (US 6,708,227). Cabrera et al. cites Kusters et al. (US 6,473,775) as background information relating to snapshot services. The Examiner alleges that Kusters et al. discloses creating a differential file without suspending writes.

Claims 13-16, 19-22, and 27-30

Applicants respectfully submit that independent claim 13 is novel and patentable over Cabrera et al. because, for instance, Cabrera et al. does not teach or suggest to write data related to the write command to the first logical volume and not write the data related to the write command to a second logical volume of the second plurality of logical volumes relating to the first logical volume based on receiving the write command during a period of changing from a first status to a second status.

The present invention is directed to "keeping the consistency among the data stored in a plurality of storage volumes" (page 2, lines 16-18). The relationship between a first plurality of logical volumes and a plurality of second logical volumes is being changed to a second status which is a split status according to a command. In the prior art, the system holds writes to the logical volumes until the change of status for the logical volumes is completed to avoid introducing inconsistency in the storage volumes. In the present invention as claimed, the controller writes data related to the command to the first logical volume and does not write the data to the second logical volume relating to the first logical volume, during the status change between the first plurality of logical volumes and the second plurality of logical volumes to the second status of split. This ensures that consistency of the second plurality of logical volumes in the second status is maintained.

Cabrera et al. clearly teaches to hold writes for committing the snapshots, as shown in Fig. 7B. "Then, all writes are disabled to V1 and V2 for the committing of the snapshots, and re-enabled for a post committing of the respective volumes." Column 9, lines 61-64.

Cabrera et al. cites Kusters et al. along with other references "as background information relating to the provision of snapshot services." Cabrera et al. does not cite Kusters et al. for teaching not to hold writes for committing of the snapshots.

Kusters et al. "provides a system and method for creating a snapshot with a differential file without suspending writes" (col. 1, lines 61-63). Although Kusters et al. appears to teach that there is no need to suspend writes, it actually discloses that it is necessary to suspend writes to the free space allocated to the differential file but writes to another portion of the base volume are allowed. "When notice is received that a snapshot is to be created, existing free space is allocated on the base volume to store the differential file for the snapshot. Writes to the base volume are allowed, except that writes to the free space allocated to the differential file are prevented by the pre-allocation." Column 1, line 64 to column 2, line 2. In other words, data is written somewhere else first, and then copied to the differential file. "By pre-allocating free space on the base volume, writes to the base volume may continue while ensuring that the differential file is available to track new writes at the instant the snapshot is captured. In this manner, the snapshot system is afforded the time necessary to complete the snapshot process without having to suspend writes to the **entire** base volume. After the snapshot process is complete, data may be copied to the differential file as writes are received (copy-on-write)." Column 2, lines 4-12 (emphasis added). Kusters et al. still teaches to suspend writes to the differential file which the data is intended to be stored, but it provides another space to receive the write data so as to avoid suspending writes to the entire base volume. Therefore, the method of Kusters et al. still involves "hold request to write data" in step 604 of Fig. 6. "When the snapshot driver 235 receives a request from the file system 225 to write data to the base volume 215, the process proceeds to block 604, where the snapshot driver 235 holds the write request." Column 8, lines 60-63.

In contrast, the present invention as claimed writes data related to the command to the first logical volume without suspension. To maintain consistency of the second plurality of logical volumes, it does not write the data related to the command to the second logical volume relating to the first logical volume. This is different from the copy-on-write approach disclosed in Kusters et al. Furthermore, there is no motivation to modify Cabrera et al. by not holding writes since Cabrera et al. clearly teaches to hold writes, thereby teaching against writing data to the volume before completion of committing the snapshots.

For at least the foregoing reasons, claim 13, and claims 14-16, 19-22, and 27-30 depending therefrom, are novel and patentable over the cited art.

Claims 24 and 31

Applicants respectfully submit that independent claim 24 is novel and patentable over Cabrera et al. because, for instance, Cabrera et al. does not teach or suggest to write data related to each of the write commands to the first storage region and not write the data related to each of the write commands to the second storage region, each time of receiving each of the write commands.

As discussed above, Cabrera et al. clearly teaches to hold writes for committing the snapshots. Kusters et al. still teaches to suspend writes to the differential file which the data is intended to be stored, but it provides another space to receive the write data so as to avoid suspending writes to the entire base volume. The written data is then copied to the differential file in the copy-on-write scheme. Therefore, the method of Kusters et al. still involves "hold request to write data" in step 604 of Fig. 6.

In contrast, the present invention as claimed writes data related to the command to the first storage region without suspension. To maintain consistency of the second plurality of storage regions, it does not write the data related to the command to the second storage region relating to the first storage region. This is different from the copy-on-write approach disclosed in Kusters et al. Furthermore, there is no motivation to modify Cabrera et al. by not holding writes since Cabrera et al. clearly teaches to hold writes, thereby teaching against writing data to the volume before completion of committing the snapshots.

For at least the foregoing reasons, claim 24 and claim 31 depending therefrom are novel and patentable over the cited art.

Claims 25 and 32

Applicants respectfully submit that independent claim 25 is novel and patentable over Cabrera et al. because, for instance, Cabrera et al. does not teach or suggest to write data related to the write command to the first logical volume after changing to a split status in which a relationship between the first logical volume and the second logical volume is split, the data related to the write command being not written to the second logical volume on receiving the write command.

As discussed above, Cabrera et al. clearly teaches to hold writes for committing the snapshots. Kusters et al. still teaches to suspend writes to the differential file which the data is intended to be stored, but it provides another space to receive the write data so as to avoid suspending writes to the entire base volume. The written data is then copied to the differential file in the copy-on-write scheme. Therefore, the method of Kusters et al. still involves "hold request to write data" in step 604 of Fig. 6.

In contrast, the present invention as claimed writes data related to the command to the first logical volume without suspension. To maintain consistency of the second plurality of logical volumes, it does not write the data related to the command to the second logical volume relating to the first logical volume. This is different from the copy-on-write approach disclosed in Kusters et al. Furthermore, there is no motivation to modify Cabrera et al. by not holding writes since Cabrera et al. clearly teaches to hold writes, thereby teaching against writing data to the volume before completion of committing the snapshots.

For at least the foregoing reasons, claim 25 and claim 32 depending therefrom are novel and patentable over the cited art.

Claims 26 and 33

Applicants respectfully submit that independent claim 26 is novel and patentable over Cabrera et al. because, for instance, Cabrera et al. does not teach or suggest to write data related to the write command to the first logical region but not to the second logical region, if the controller receives the write command.

As discussed above, Cabrera et al. clearly teaches to hold writes for committing the snapshots. Kusters et al. still teaches to suspend writes to the differential file which the data is intended to be stored, but it provides another space to receive the write data so as to avoid suspending writes to the entire base volume. The written data is then copied to the differential file in the copy-on-write scheme. Therefore, the method of Kusters et al. still involves "hold request to write data" in step 604 of Fig. 6.

In contrast, the present invention as claimed writes data related to the command to the first logical region without suspension. To maintain consistency of the second plurality of logical regions, it does not write the data related to the command to the second logical region relating to the first logical region. This is different from the copy-on-write approach disclosed in Kusters et al. Furthermore, there is no motivation to modify Cabrera et al. by not holding writes since Cabrera et al. clearly teaches to hold writes, thereby teaching against writing data to the volume before completion of committing the snapshots.

For at least the foregoing reasons, claim 26 and claim 33 depending therefrom are novel and patentable over the cited art.

CONCLUSION

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,

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